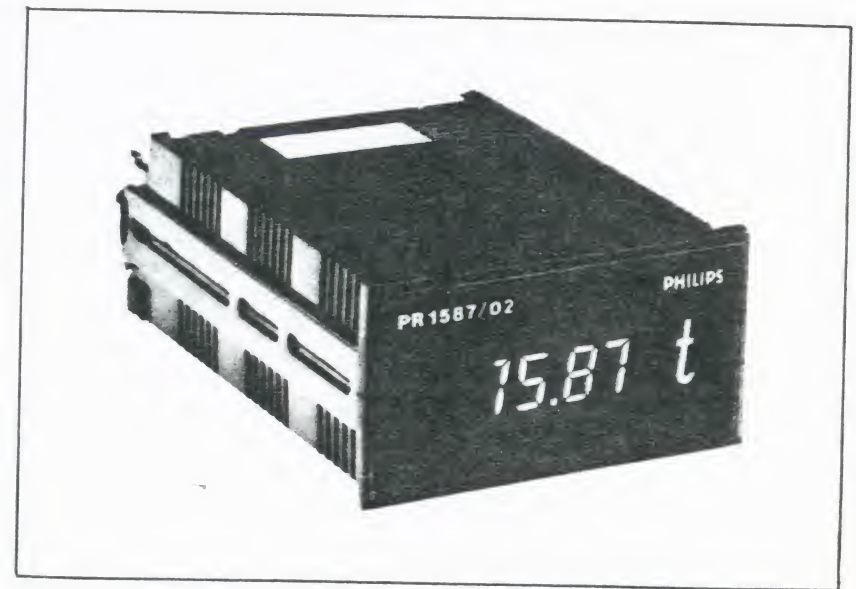


# Digital panel-meter PR 1587/02

Instruction manual  
Gerätehandbuch  
Notice d'emploi

9499 053 21501  
880301



#### PLEASE NOTE!

In correspondence concerning this instrument, please quote the type number and serial number as given on the plate.

If available, also note the software rel.no., printed on the label at the EPROM's on the main print.

#### IMPORTANT

As the instrument is an electrical apparatus, it may only be operated by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel.

#### BITTE BEACHTEN!

Bei Schriftwechsel über dieses Gerät bitte die Typennummer und die Geräte-nummer angeben! Diese befinden sich auf dem Typenschild des Gerätes.

Falls vorhanden, geben Sie auch die Software Rel.-Nr. an, die Sie auf dem Etikett der EPROMs auf der Leiterplatte im Gerät finden.

#### WICHTIG

Da das Gerät ein elektrisches Betriebsmittel ist, darf die Bedienung nur durch eingewiesenes Personal erfolgen. Wartung und Reparatur dürfen nur von geschultem, fach- und sachkundigem Personal durchgeführt werden.

#### NOTER, S.V.P.

Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez toujours indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Si disponible, veuillez également indiquer le software rel. no. que vous trouvez sur l'étiquette des EPROMS qui se trouvent sur la platine principale.

#### IMPORTANT

Comme l'instrument est un équipement électrique, le service doit être assuré par du personnel qualifié. De même, l'entretien et les réparations sont à confier aux personnes suffisamment qualifiées.

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## 1. DESCRIPTION

### 1.1 GENERAL

The PR 1587/02 is a 4 1/2 digit panel meter for weighing applications which require a compact reliable remote display unit.

The instrument has a resolution of 1 part in  $\pm 19999$  counts, or 0.005 % of full scale. It offers voltage ranges of  $\pm 1.9999$ ,  $\pm 19.999$  and  $\pm 199.99$  V DC.

Upon delivery it is set for 0...19.999 V DC.

By using an external DC voltage reference, any of these ranges can be configured for 3-wire ratio measurement with readout from 0 to 1.9999.

Each instrument contains the circuitry for all ranges. The range is changed by opening and closing the appropriate switches on the printed circuit board via installation of push-on shunt blocks into the pin-forest.

Standard features include selectable decimal point location, display hold, test, and blanking.

The instrument fits a standard 1/8 DIN panel cutout (92 x 45 mm) and requires a depth of less than 104 mm behind the panel. Each unit is housed in a polycarbonate case.

### 1.2 THEORY OF OPERATION

The PR 1587/02 uses the dual slope method of conversion including automatic zeroing before each reading and doing so with a minimum of parts for increased reliability. At the beginning of a conversion, the voltage across  $C_{int}$  is zero. The signal is then applied to the integrator and the voltage across  $C_{int}$  rises by the formula:

$$U_{cint} = U_{in} \frac{T_1}{R_{int} C_{int}}$$

At the end of a fixed period of 10000 counts,  $T_1$ , the counters are reset to 00000. The signal input is turned off and a stable reference voltage of the opposite polarity is now applied to the input. Since the reference voltage is constant, the slope, in volts/sec, during this second period,  $T_2$ , is constant and independent of input signal levels. The time required to discharge the capacitor back to zero volts is then proportional to the signal voltage.

The relationship between the signal integration time,  $T_1$ , and the reference integration time,  $T_2$ , can be expressed by the formula:

$$U_{\text{ref}} T_2 = U_{\text{in}} T_1$$

After the clock is stopped by the capacitor voltage reaching zero, a third period,  $T_3$ , allows the circuit to auto-zero the integrator and comparator for the next reading. A low level on the HOLD input prevents the reset pulse from starting the counters.

Note: Capacitor voltage  $U_c$  is equal to  $U_2 - U_1$

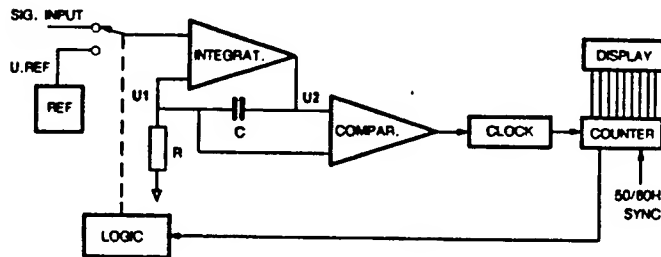


Fig. 1 Block Diagram of the PR 1587/02

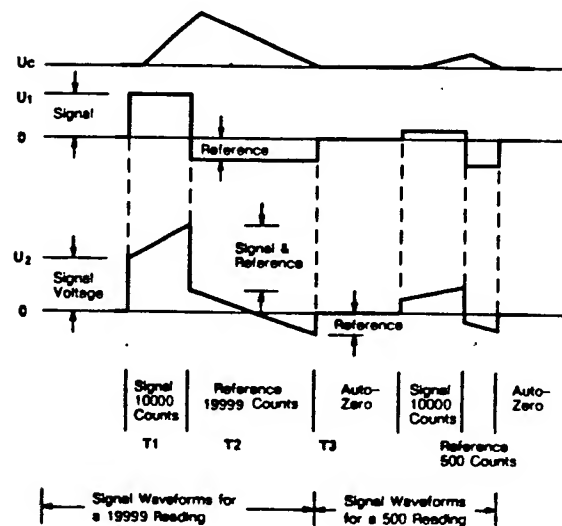


Fig. 2 Voltage Wave Forms at  $U_1$  and  $U_2$

## 2. SAFETY INSTRUCTIONS

### Safety Characteristics

The PR 1587/02 has been designed and tested in accordance with "Safety Requirements for Electronic Measuring Apparatus", and has been supplied in a safe condition. This manual contains some information and warnings which must be followed by the user to ensure safe operation and to retain the apparatus in a safe condition.

### 2.1 INITIAL INSPECTION

Check the contents of the shipment for completeness and note whether any damage has occurred during transport. If the contents are incomplete, or there is damage, a claim should be filed with the carrier immediately, and the Philips Sales or Service organisation should be notified in order to facilitate the repair or replacement of the instrument.

### 2.2. BEFORE COMMISSIONING

Before putting the PR 1587/02 into operation after storage or transport, visually check it for physical damage.

#### • Mounting

The instrument is suitable for panel mounting. Please observe the required environmental conditions as given in the technical data.

### 2.3. MAINTENANCE AND REPAIR

#### • Failure and excessive stress:

If the Module is suspected of being unsafe, take it out of operation permanently. This is the case when the Module

- shows physical damage
- does not function anymore
- is stressed beyond the tolerable limits (e.g. during storage and transportation)

#### • Repairs

Attention!

Maintenance or repairs must be performed only by trained personnel who are aware of the risks. Ensure that the construction of the instrument is not altered to the detriment of safety. Above all, leakage paths, air gaps, and insulation layers must not be reduced.

- Static sensitive components

The instrument contains electrical components which are susceptible to damage from static discharge. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.

- For special attention

When soldering inside the instrument it is essential

- to switch off the PR 1587/02, and
- to use a low-voltage soldering iron, galvanically separated from the mains side.

Suitable soldering irons should have temperature control and different types of nozzles (pin point tips), e.g. Weller Magnastat WTCP or WECP, Erska TC 70/24 V.

If a higher wattage-rating soldering iron is used, excessive heat can cause the etched circuit wiring to separate from the board base material.

In general use short time heating with high tip temperature at a small point, avoid long time heating.

### 3. TECHNICAL DATA

#### 3.1 GENERAL DATA

- Type PR 1587/02
- Ordering number 9405 315 87021
- A/D Conversion
 

Technique	Dual slope, average-value
Input integration period	100 msec
Read rate	2.5 / second
- Accuracy at 25°C
 

Max error	±0.01% of reading ±2 counts
Span tempo	±0.01 % of reading/°C
Step response	1 s, 10 s
Warm-up to rated accuracy	10 min
- Display
 

Type	7 segment, red LED
Digit height	14.2 mm (0.56 in)
Symbols	-1.8.8.8.8
Decimal Points	4 positions programmed internally or at the connector by sourcing <50 µA from digit drive to D.P. select
Overrange indication	4 least-significant digits flash
- Environmental

The following environmental data are valid only if the instrument is checked in accordance with the official checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS organization in your country or by

PHILIPS INTERNATIONAL B.V.  
INDUSTRIAL & ELECTRO-ACOUSTIC SYSTEMS DIVISION;  
EINDHOVEN  
THE NETHERLANDS

Operating temperature	0 to +60 °C
Storage temperature	-40 to 85 °C
Relative humidity	95% RH to +40 °C (non-condensing)
Radio interference voltage	according to DEUTSCHE BUNDESPOST-Verfügung 1046/84 (acc. to VDE 0871: Limit class B)

### ● Mechanical

Bezel	96 x 48 x 5.1 mm (3.78 x 1.89 x 0.20 in)
Depth behind bezel, with connector	104 mm (4.09 in)
Panel cutout	92 x 45 mm (3.62 x 1.77 in)
Weight	400 g (14 oz)
Case material	94 V-0 UL-rated polycarbonate

### ● Connection

Mains/Analog input via barrier terminal strip TB 1 with six # screw connections for mains supply and analog input signal

Digital I/O, and analog outputs via PCB edge connector J 1 with a double row of 18 pins with 3.96 mm (0.156 in) spacing between pins

- Protection acc. to IP 20 for housing and IP 40 for front panel
- Safety class 1 (protective earth) acc. to IEC 348
- Warming-up time 10 min
- MTBF  $\geq 35\,000$  hour

## 3.2 INPUTS

### ● Mains supply

Standard AC power voltage	115 or 230 V ac $\pm 15\%$
AC frequency range	48 to 62 Hz
Power consumption	2.4 W

### ● Analog input

Range	$\pm 1.9999$ VDC	$\pm 19.999$ VDC*	$\pm 199.99$ VDC	$\pm 650.0$ VDC
Resolution	0.1 mV	1 mV	10 mV	100 mV
Maximum input	250 V rms, 350 Vp	750 V rms, 1000 Vp	750 V rms, 1000 Vp	750 V rms, 1000 Vp

Input resistance	1 Gohm	1 Mohm	1 Mohm	1 Mohm
Bias current	10 pA	1 pA	1 pA	1 pA

Configuration differential  
Zero automatic  
Span adjustment  $\pm 5\%$

\* As set upon delivery

### ● Digital inputs

(positive true referenced to DIG GND)

Input:	Logical '0'	Logical '1'	Sink	Source
METER HOLD	0 to 1.7 V	1.8 to 5.0 V	0.016 mA	0.6 $\mu$ A
LAMP TEST	0 to 0.79V	1.9 to 5.0 V	1.0 mA	0.6 $\mu$ A
DISPLAY BLANKING	0 to 0.64V	1.0 to 5.0 V	1.5 mA	2.0 $\mu$ A
D.P.SELECT				< 50 $\mu$ A

## 3.3

### OUTPUTS

#### ● Output voltages

+4.7 VDC  $\pm 5\%$  at 10 mA max  
-4.6 VDC  $\pm 5\%$  at 10 mA max

!Not short-circuit proof!  
Only to be used for controlling the digital inputs.

## 4.

### ACCESSORIES

- 1 Connector
- 1 Lens printed with t
- 1 Instruction manual

## 5. MOUNTING AND CONNECTING

### 5.1 MECHANICAL INSTALLATION

Fig. 7 on page 8-1 illustrates the mounting method. The procedure is as follows:

- Remove main board edge connector J1, if installed.
- Loosen the two clamp screws (with a #8 PHILLIPS-head screw driver) on the rear of the case until the slide clamps can be rotated. The screws should be loosened enough to allow for the panel thickness.
- Push the two slide retainers towards the rear of the unit and remove them.
- Working from the front of the panel, insert the meter into the panel cutout (see figure 7).
- Insert slide retainers back onto the case and push them up tightly against the rear of the panel.
- Rotate slide clamps back into original position and tighten clamp screws just enough to hold the case in place. Never overtighten clamp screws.
- Reinstall any connectors that have been removed.

### 5.2 DISMANTLING

Dismantling is shown in fig. 9.

Before dismantling ensure that the display unit is disconnected from all power sources. The instructions given in paragraph 2.3. have to be observed.

### 5.3 INTERFACING

#### 5.3.1 Screw Assignments of Terminal TB1

Refer to Safety Instructions in section 2 prior to performing any power connections. The rear view of the case with connectors is shown in the following figure. It identifies the connector and screw-terminal barrier and their respective terminal numbers or letters. Please refer to this figure when making power and signal connections.

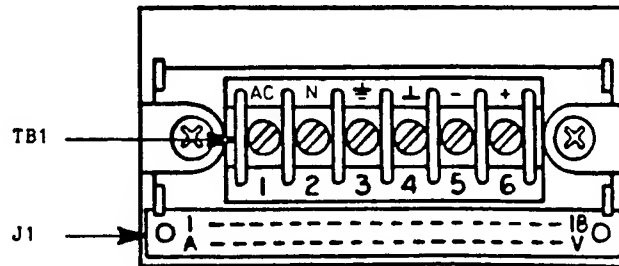


Figure 3 Rear View of the Instrument

#### 5.3.2 Pin Assignments of Connector J1

FUNCTION	PIN	PIN	FUNCTION
N.C.	A	1	N.C.
"	B	2	"
"	C	3	"
"	D	4	"
"	E	5	"
1999.9 DP4	F	6	"
199.99 DP3	H	7	"
19.999 DP2	J	8	"
1.9999 DP1	K	9	"
DP select	L	10	"
N.C.	M	11	-4.6 V DC
N.C.	N	12	+4.7 V DC
-EXC.	P *	13	+REF
LAMP TEST	R *	14	+EXC
DIG.GROUND	S	15	HOLD
ANA.GROUND	T	16	N.C.
BLANKING	U	17	N.C.
Osc.(100 kHz)V *		18	N.C.

\* not to be used!

#### 5.3.3 Mains Connection

The instrument is connected to the mains via screws 1 (AC HI), 2 (AC LO), and 3 (AC P.E.) of terminal TB 1 (see also fig.3 on page E 5-2)

Upon delivery, the instrument is set to 230 V AC  $\pm 15\%$ . For changeover to 115 V AC proceed in accordance with instructions given in para. 6.1.

#### ATTENTION

As this instrument has no mains switch, it is in operation when the mains voltage is connected. Therefore, connect the instrument only to the mains, when it is ready for operation - after having finished the adjustments.

#### 5.3.4 Analog Input and Grounding

The instrument is to be connected to the analog input signal via screws 6 (SIGN. HI), 5 (SIGN. LO), and 4 (SIGN. GROUND).

For best results, shielded, twisted cable (as e.g. type LiVCY) should be used for the input signal, with the shield terminated to Protective Earth at terminal TB1 screw 3. ( $\perp$ )

Analog Ground and Digital Ground are internally connected and should not be connected externally. The correct grounding method is to connect the low side of the signal to SIG LO, which is tied to ANA GND internally via a shunt block in position S1 while the common for digital inputs/outputs is connected to DIG GND. This allows the digital currents to flow only in the digital ground and prevents an IR drop in the analog ground that would be misread as a signal. It should be noted that a small voltage can exist between ANA GND (pin T) and DIG GND (pin S).

If common mode rejection is required between signal low (SIG LO) and analog ground (ANA GND), remove the shunt block at position S3-A which disconnects SIG LO from ANA GND and externally add a parallel RC network (10 Mohm shunted by 0.1  $\mu$ F) between SIG LO and ANA GND. The 10 Mohm resistor provides a return path for the meter bias current required by SIG LO. A common mode voltage up to  $\pm 1$  V can now be tolerated and rejected by 86 dB.

#### 5.3.5 Digital Input Signals

(positive true referenced to DIG GND)

Input:	Logical '0'	Logical '1'	Sink	Source
METER HOLD	0 to 1.7 V	1.8 to 5.0 V	0.016 mA	0.6 $\mu$ A
LAMP TEST	0 to 0.79V	1.9 to 5.0 V	1.0 mA	0.6 $\mu$ A
DISPLAY BLANKING	0 to 0.64V	1.0 to 5.0 V	1.5 mA	2.0 $\mu$ A
D.P.SELECT				<50 $\mu$ A



### • HOLD (Pin 15)

When high (or open), the A/D will be free-run with equally spaced measurement cycles every 40,000 clock pulses.

If taken low, the converter will complete the full measurement cycle and then hold this reading as long as HOLD is low. A positive pulse (greater than 300 ns) will now initiate a new measurement cycle, beginning with between 9,001 and 10,001 counts of auto-zero time. If the pulse terminates before the full measurement cycle (40,002 counts) is complete, it will not be recognized and the converter will simply complete the present measurement. An external indication that a full measurement cycle has been completed is that the first strobe pulse will occur 101 counts after the end of this cycle. Thus, if HOLD is low and has been low for at least 101 counts, the converter is holding and ready to start a new measurement when pulsed high.

### • LAMP TEST (Pin R)

The LAMP TEST function instructs the meter to light the minus sign and all digits on the display to verify the display is operating properly. The decimal points do not light when LAMP TEST is activated.

To test the display, connect LAMP TEST (J1-R) to DIG. GND. (J1 - S).

### • BLANKING (Pin U)

The digital display may be blanked by grounding the BLANKING input. The BLANKING input must be open for normal display operation. The polarity sign and decimal points are not blanked by grounding the BLANKING input, but they will flash, if the displayed reading exceeds  $\pm 19999$  counts.

### • Decimal points

Any of the four decimal points can be lighted by connecting the appropriate pin on the rear connector J1 to PIN L. If the decimal point should be controlled via a transistor or an IC., it must be capable of sinking 10 mA.

### 5.3.6 Output Voltages

The instrument delivers regulated voltages of +4.7 V DC and -4.6 V DC of  $\pm 5\%$ . Maximum current may be 10 mA.

#### Attention!

It has to be observed that a. m. voltages are not short-circuit proof. Overloading will destroy the instrument.

They may therefore only be used for controlling the digital inputs.

## 6. ADJUSTMENTS AND CALIBRATION

### 6.1 ADJUSTING TO LOCAL MAINS SUPPLY

Before connecting the instrument to the mains supply, it should be noted that it has no mains switch and is therefore ready for operation as soon as the supply is connected to it.

The instrument operates on mains voltages of 115 or 230 V AC and 50/60 Hz. Upon delivery it is set to 220 V AC.

For changing over from 230 V AC to 115 V AC, refer to the figure below and proceed as follows:

- Remove power lines from meter and remove the meter from the case
- Remove jumper W4 on the PCB
- Add the two jumpers on the transformer bobbin W8 and W9. The meter is now wired for 115 V.

To change the meter from 115 V to 230 V operation, reverse the above steps.

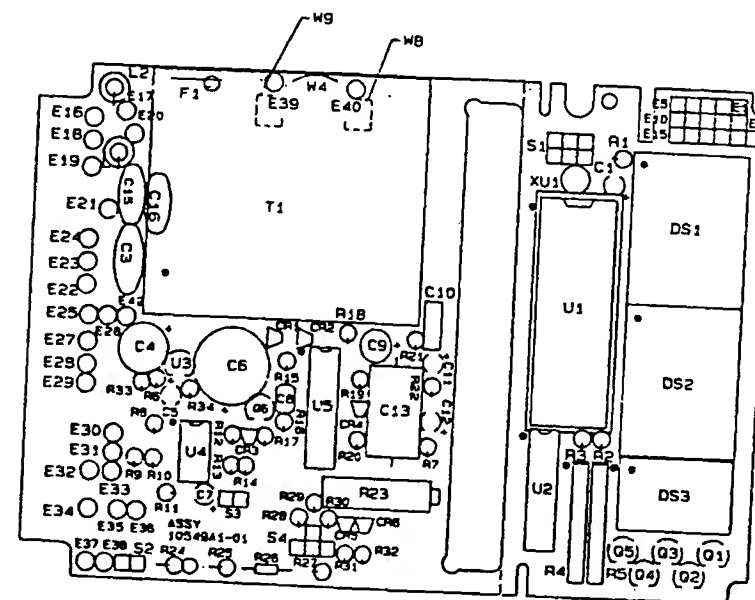


Fig. 4 Mains Adjustment Facilities

## 6.2

## DECIMAL POINT SELECTION

Any of the four decimal points to the left of the four least significant digits can be lit by installing a shunt block in the proper S1 location on the display board or by connecting the appropriate decimal point pin of the rear connector, J1, to the decimal point select pin, L, of J1.

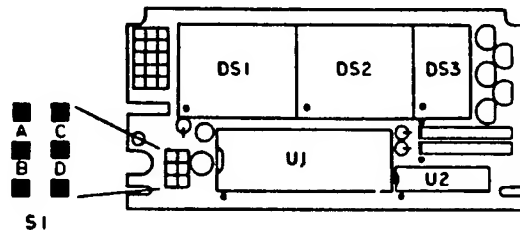


Figure 5 Decimal Point Selection - Display Board

Decimal Point	S1	J1
1.XXXX (DP1)	A	K to L
1X.XXX (DP2)	B	J to L
1XX.XX (DP3)	C	H to L
1XXX.X (DP4)	D	F to L

## 6.3.

## INPUT VOLTAGE RANGE SELECTION

The PR 1587/02 can be configured in the field for a given range by selecting the proper input attenuator value. This selection process is achieved with the installation of jumpers in the proper S2 and S4 locations, a wire jumper in the W10 position, and the opening or closing of solder switches at positions H, I, J, K and L.

**Attention!**

Changing the range requires in any case a new calibration as described in paragraph 6.4.

Range	S2	S4	W10	H	I	J	K	L
2 V DC	None	None	Install	C	C	0	C	0
20 V DC	A	B	Remove	C	C	0	C	0
200 V DC	A	C	Remove	C	C	0	C	0
650 V DC	A	A	Remove	C	C	0	C	0

C = Close 0 = Open

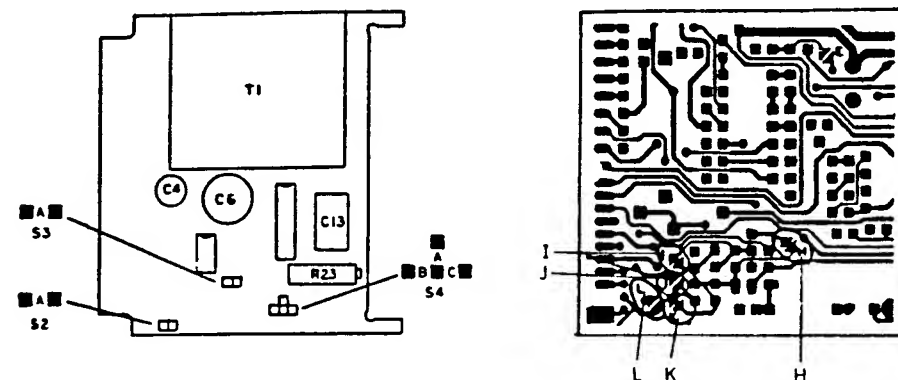


Figure 6 Main Board Switches

## 6.4.

## CALIBRATING THE INSTRUMENT

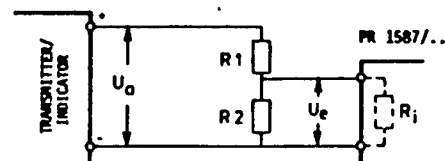
The PR 1587/02 was calibrated at the factory with a precision voltage source to a range of 0 to 19.999 VDC. Frequent calibration is not necessary due to the stability and internal accuracy of the meter. If recalibration is necessary, use the following procedure:

- To calibrate, remove the red lens from the front of the meter. Insert a blade screwdriver under the notch at the bottom of the lens and gently pry it off.
- Shorten the input signal connections and verify that the display reads 0000.
- Apply an input voltage equal to 95 % of the high end of the range selected.
- Locate the Span (S) potentiometer (R23) in figure 6.
- Adjust R23 until the display reads 19000  $\pm$  1 count.

## 6.5 ADAPTING THE PR 1587/02 TO THE TRANSMITTER

As in most cases the voltage range of the PR 1587/02 will not correspond to the calibrated output voltage (span) of the supplying Weight Transmitter, the PR 1587/02 needs to be adapted. This can be done e.g. by means of a voltage divider.

When calculating the values of the required resistors please note that a certain maximum current of transmitters output must not be exceeded and that the temperature coefficient of the GAIN of that Transmitter will be impaired due to the resistors of the voltage divider.



$U_a$  = max. output voltage of the Transmitter  
 $U_e$  = max. input voltage of the PR 1587/02  
 $R_i$  = input resistance of the PR 1587/02

Example of calculation:

maximum display range of the PR 1587/02 = 19.999  
 full scale deflection = 8.000 t =  $U_e$  = 8.000 V

$U_a$  = 10 V = f.s.d. (full scale deflection)  
 $R_i$  = 1 MOhm  
 $R_1$  = 4.7 kOhm  
 $R_2$  = ?

$$R_2 = \frac{R_1 \times U_e}{U_a - U_e} = 18.8 \text{ kOhm}$$

$$I = \frac{U_a}{R_1 + R_2 // R_i} = 0.42 \text{ mA}$$

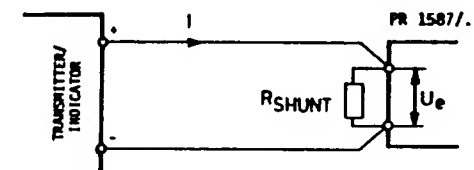
The maximum cable length between the voltage output of the Transmitter and the PR 1587/02 depends on the specification of the respective Transmitter. For interconnecting, a cable of type LiYCY is recommended. It should be routed separately from power supply and power signal cables (distance of approx. 1 m) and connected as mentioned in para. 5.3.4.

With longer interconnection cable between Weight Transmitter and PR 1587/02, it could be advisable to use the current output of the Weight Transmitter instead of its voltage output.

In this case the input of the PR 1587/02 must be shunted as shown in the sketch below. When calculating the value of the shunt, a given maximum burden of the respective Transmitter must not be exceeded.

Additionally it must be observed that the temperature coefficient of Transmitters GAIN will be impaired. The power carrying capacity of the shunt must be generously designed due to its self-heating.

The internal resistance of the display unit is so high that it can be neglected.



Example of calculation:

$I_a$  = max. output current of the Transmitter at f.s.d. = 20 mA

$U_e$  = required input voltage of the PR 1587/02 at f.s.d. = 8 V

full scale deflection = 8.000 t

$$R_{shunt} = \frac{U_e}{I_a} = \frac{8 \text{ V}}{0.02 \text{ A}} = 400 \text{ Ohm}$$

For interconnecting a cable of type LiYCY is recommended.

It should be routed separately from power supply and power signal cables (distance of approx. 1 m) and connected as mentioned in para. 5.3.4.

## 7. MAINTENANCE

For maintenance, check the instrument from time to time for proper functioning. Should the instrument be subject to failures, call your local Philips Service Organisation for assistance. In addition observe the relevant safety instruction in paragraph 2.3.

### 7.1. INPUT FUSE

The power input to the PR 1587/02 is protected by a carbon composition resistor fuse. If the meter does not light and it is suspected that the fuse has been blown, check the continuity of the primary circuit. The resistance from power Hi to power Lo will be approximately 110 Ohm for a 115 V meter and 470 Ohm for the 230 V meter.

If the fuse (F1) is blown, it is imperative that it is replaced by an identical part, failure to do so will void the warranty (see fig. 9). The fuse is an Allen-Bradley 1/8 W, 10 Ohm,  $\pm 10\%$  carbon composition resistor. It is available under PHILIPS service code number 5322 111 30828.

### 7.2. RECOMMENDED SPARE PARTS

Item	Description	Service code number
1	Filter screen with t	5322 459 40636
2	Filter screen with kg	5322 459 40637
3	36-pol. connector "J1"	5322 266 61016
F1	Carbon resistor 10 Ohm, 10 %, 1/8 W	5322 111 30828
U1	ICL 7135 CPI	5322 209 73326
U2	SN 74 LS 247 N	5322 209 85613
U4	LM 358 N	4822 209 81472
DS1/DS2	MAN 6610	5322 209 82717
DS3	MAN 6660	5322 209 73328
C4	Electrolytic 330 $\mu$ F, 16 V	5322 124 41623
C6	Electrolytic 2200 $\mu$ F, 16 V	4822 124 40723

8.

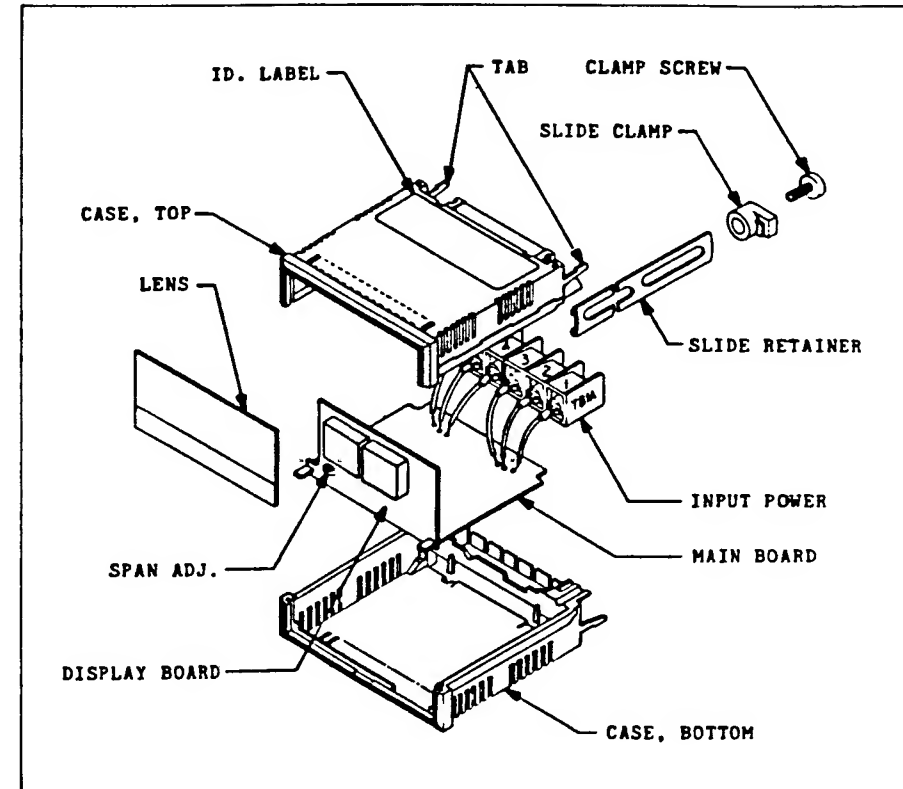
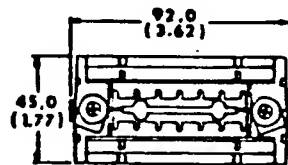
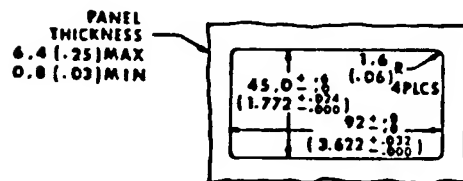
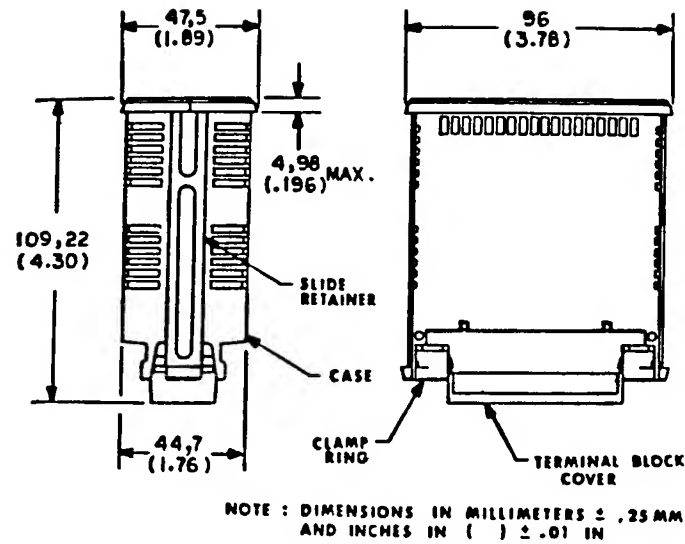


Fig. 9 Dismantling the PR 1587/..

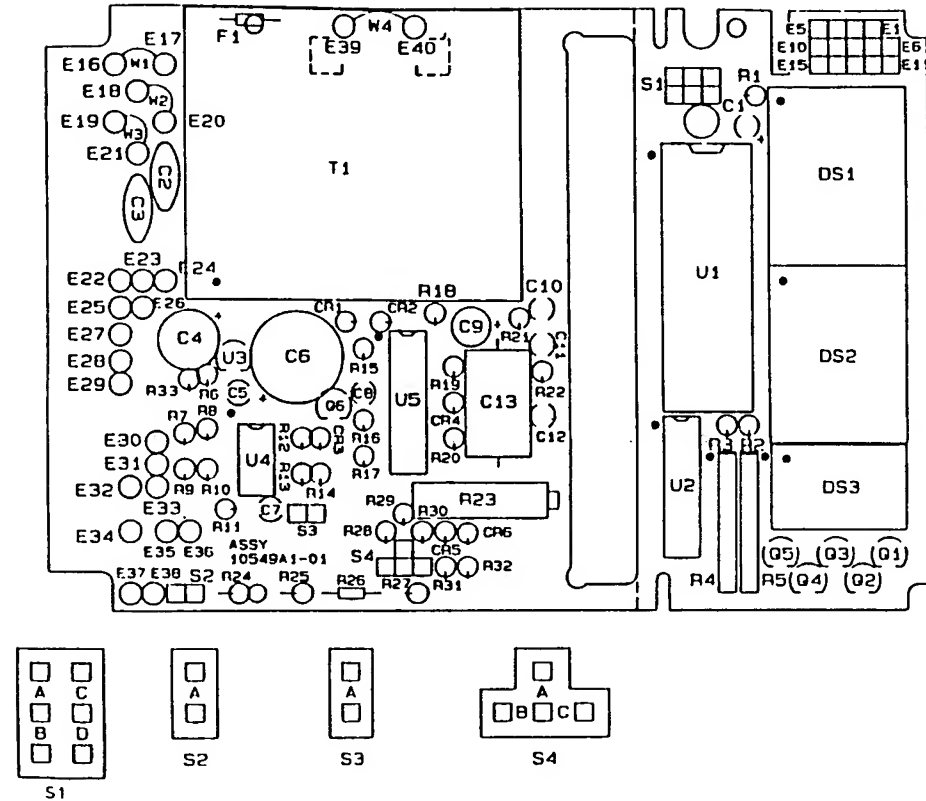
# 8. ILLUSTRATIONS



REAR VIEW  
(TERMINAL BLOCK COVER AND BEZEL NOT SHOWN FOR CLARITY)  
SLIDE CLAMPS ROTATED AND SLIDE RETAINERS REMOVED AS SHOWN FOR INSTALLATION.

Fig. 7

Dimensions  
and Panel Cut-Out



Component view of Main and Display Board

Fig. 8

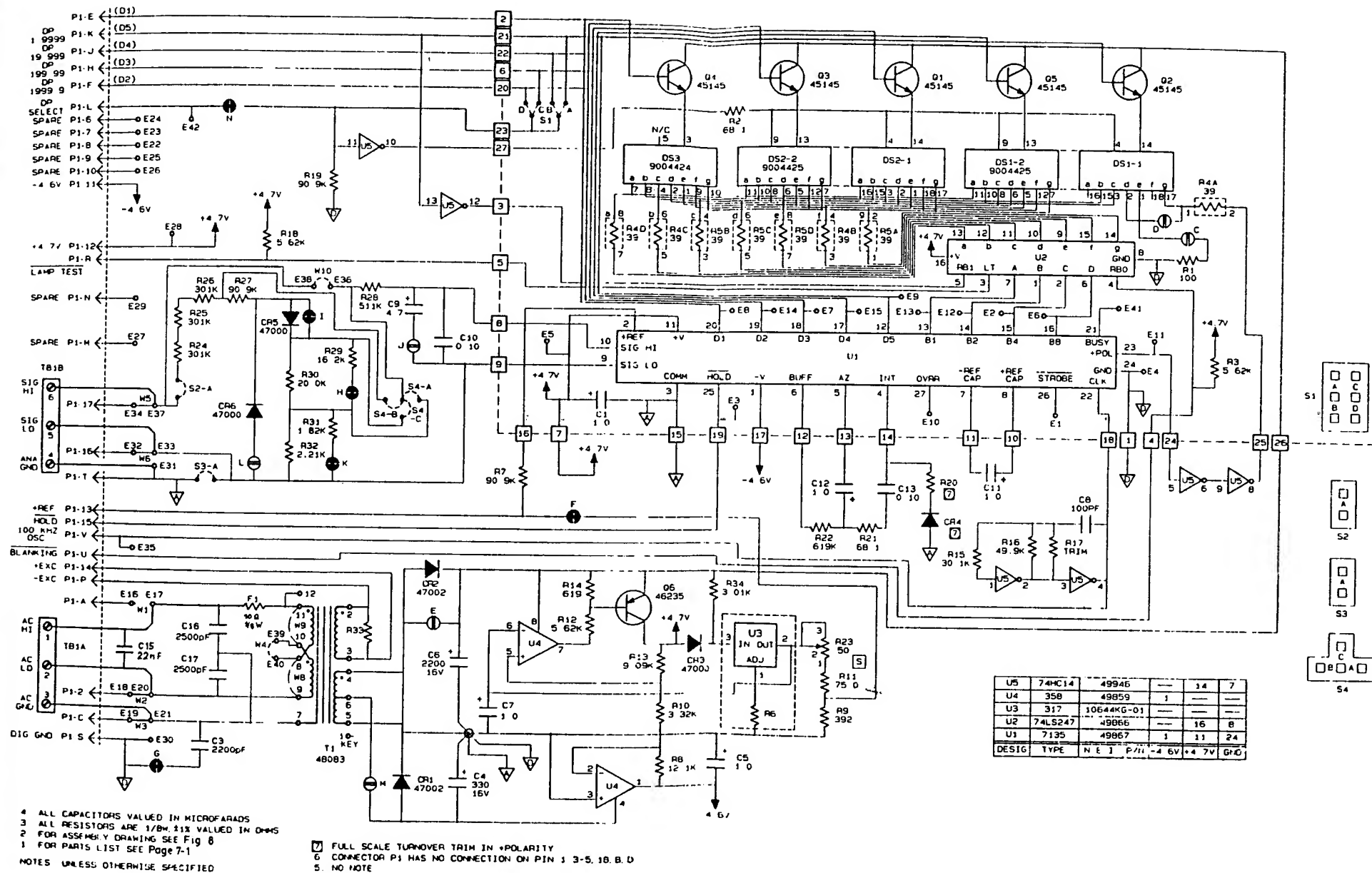


Fig. 10 Schematic Diagram of Main and Display PCB